BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

B70 02012

SUBJECT: Candidate Functions for Apollo Lunar Surface Television Systems - Case 320

DATE: February 6, 1970

FROM: J. C. Slaybaugh

MEMORANDUM FOR FILE

As a preliminary step in the definition of television system requirements for Apollo lunar surface use, the attached list of candidate system functions has been developed. The list has been made as complete as possible to provide a broad basis from which a ranked set of functional requirements can be derived. These in turn may be evaluated in light of system design factors and competing system capabilities to produce an overall set of television system requirements. No attempt has yet been made to rank or evaluate the candidate functions, nor has any judgment been made as to the relative merits of performing the functions with other systems (e.g. film camera).

Based upon a set of broad television system objectives, the candidate functions have been divided into three time-based categories: real time, near-real time, and non-real time. These time designations refer to the time at which the data transmitted by TV is used. By definition, all lunar surface activities occur in real time; it is the time of data usage upon which separation is based. Thus, although the monitoring of scientific instrument operation can be used in real time for trouble shooting, it is also considered a non-real time function, as the data provided is used in post flight analyses to document scientific activity.

The above categories were further divided on the basis of science, operations and engineering. Although these categories have frequently been used as major divisions, it is felt that the current matrix, using time-based separation of the major categories, provides a unique representation of the candidate functions. On that basis, the overall matrix outline appears as follows:

I. Real Time Observation and Support
   A. Observation
      1. General Surveillance
      2. Public Information Office (PIO)
      3. Post-mission surface observation

   B. Support
      1. Science
      2. Operations
      3. Engineering

II. Near-Real Time Ground Assistance
   A. Science
   B. Operations
   C. Engineering

III. Non-Real Time Documentation
   A. Science
   B. Operations
   C. Engineering

The complete list of candidate functions, with examples, is included in Attachment 1. That list may be evaluated and ranked to provide a set of functional requirements for system design. Motion rendition, resolution, color and other parameters can then be defined by the respective users and compared with competing system performance to define a final set of television system requirements. The current list is thus a "shopping list" of functions designed to initiate selection of Apollo lunar surface television system requirements.

2032-JCS-tla

J. C. Slaybaugh

Attachment

II. Near-Real Time Ground Assistance
   A. Science
   B. Operations
   C. Engineering

III. Non-Real Time Documentation
   A. Science
   B. Operations
   C. Engineering

The complete list of candidate functions, with examples, is included in Attachment 1. That list may be evaluated and ranked to provide a set of functional requirements for system design. Motion rendition, resolution, color and other parameters can then be defined by the respective users and compared with competing system performance to define a final set of television system requirements. The current list is thus a "shopping list" of functions designed to initiate selection of Apollo lunar surface television system requirements.

2032-JCS-tla

J. C. Slaybaugh

Attachment

Attachment 1

CANDIDATE TELEVISION FUNCTIONS

I. REAL TIME OBSERVATION AND SUPPORT

A. Observation

1. General Surveillance - to maintain ground awareness of astronaut location and activities as an evaluation of mission progress.

2. Public Information Office (PIO) - to provide commercial-quality television coverage of lunar surface activities to generate public interest and support for the Apollo Program.

a. Astronaut activities - observe timeline sequence.

b. Terrain - observe lunar features.

c. Environment - observe lunar environment and its interaction with spacecraft and equipment.

d. Equipment - observe operation and condition of equipment.

3. Post-mission Lunar Surface Observation - to provide a visual account of lunar surface activities subsequent to astronaut departure from the lunar surface.

a. LM ascent

b. Equipment status

c. Lunar events

i. Short term (e.g. land slides)

ii. Long term (e.g. dust accumulation)

I. REAL TIME OBSERVATION AND SUPPORT (CONT'D)

B. Support

1. Science - to provide a visual basis for expert advice aimed at optimization of scientific investigation during extravehicular activity (EVA).

   a. Geology - to provide visual selenographic description to earth based geologists for real time interpretation and analysis.

      i. Broad scale - general geologic content of region (e.g. craterfields, smooth mare, mountains).
      ii. Medium range - individual form of unit or feature (e.g. crater, hill, rille).
      iii. Local - detailed structure of sampling area (e.g. crater wall, rille steppe, crater lip).
      iv. Close up - detailed structure of sample (e.g. grain structure,size, shape).

   b. Undetermined science - to provide real time visual monitoring of as yet undefined scientific activities.

2. Operations - to provide visual information for operational monitoring, planning and activities.

   a. Nominal operations - reduce requirements for verbal descriptions.

   b. Anomalous operations - aid in development of work-around procedures. (e.g. Apollo 12 RTG removal)

   c. Traverse alteration - change planned traverse path during EVA based upon scientific, operational or engineering considerations. (e.g. Apollo 12 mounds)

   d. LM location - provide visual information to aid in precise location of LM during mission (e.g. Apollo 11 camera pan).

   e. Navigation - provide visual information to verify astronaut/LRV position.

3. Engineering - to provide visual information on hardware and its operations.

   a. Monitoring - verification of hardware performance (e.g. Apollo 12 ALSEP skirt).

   b. Repair - support repair and/or analysis of malfunctioning hardware (e.g. Apollo 12 TV camera & Hasselblad handles).

II. NEAR-REAL TIME GROUND ASSISTANCE

To provide information for alteration of future traverses during periods between extravehicular operations.

A. Science - alteration of follow-on traverse timelines to investigate unexpected scientific data (e.g. Apollo 12 mounds).

B. Operations - alteration of pre-planned EVA based upon operating procedures.

1. Location - account for actual landing point.

2. Conditions - plan for unexpected environmental conditions.

a. Terrain - (e.g. unexpected slopes, surfaces, structures).

b. Soil - (e.g. unexpected structure, properties, bearing).

c. Environment - (e.g. unexpected lighting, interaction with equipment).

C. Engineering - alteration of EVA due to non-nominal equipment operation.

1. Failure - plan alternate equipment usage

2. Superior performance - plan for extended equipment usage based upon better-than-predicted performance.

III. NON-REAL TIME DOCUMENATION

To provide visual data on scientific, operational and engineering activities for post-flight analysis.

A. Science

1. Geology - provide data on geologic structures and interrelationships.

   a. Broad scale - general geologic content of region.
   b. Medium range - individual form of unit or feature.
   c. Local - detailed structure of sampling area.
   d. Close-up - detailed structure of sample.

2. Scientific instrument emplacement - provide data for evaluation of experiment performance.

   a. Deployment activity.
   b. Deployed configuration (e.g. Apollo 11 seismic experiment leveling).

3. Geography - provide data for mapping.

4. Medical experimentation - obtain correlation between astronaut activity and medical telemetry data (e.g. walking rate/BTU correlation).

5. Undefined experiments - document as required.

B. Operations

1. Nominal operations - reduce requirements for verbal descriptions (e.g. photograph and sample logging).

2. Techniques - evaluate operating procedures.

3. LM location - document LM location as a basis for activity location and documentation.

4. Astronaut/rover location - provide visual activity time-history.

C. Engineering - to provide data for hardware development.

1. Equipment status and operation (e.g. Apollo 12 tools, tool carrier, dust accumulation).

2. Nominal equipment performance (e.g. LRV wheel soil interaction)

3. Equipment failure (e.g. Apollo 12 sample bag redesign, Hasselblad camera handle redesign).

BELLCOMM, INC.

Subject: Candidate Functions for Apollo Lunar Surface Television Systems - Case 320

J. C. Slaybaugh

Distribution List

NASA Headquarters

D. A. Beattie/MAL
G. P. Chandler/MAO
R. J. Green/MAL
T. A. Keegan/MA-2
C. M. Lee/MA
B. Milwitzky/MAL
L. R. Scherer/MAL
J. D. Stevenson/MO
W. E. Stoney/MA
R. Toms/MAL

MSC

A. J. Calio/TA
C. R. Edmiston/EE2
M. A. Faget/EA
G. C. Franklin/CF131
D. B. Pendley/PA
C. H. Perrine/PA
R. G. Rose/FA3
J. H. Sasser/TJ
R. S. Sawyer/EE
H. H. Schmitt/CB
J. R. Sevier/PD
W. M. Speier/PD
T. P. Stafford/CB
J. G. Zarcaro/PD

Bellcomm, Inc.

A. P. Boysen, Jr.
F. El Baz
J. J. Hibbert
N. W. Hinners
B. T. Howard
D. B. James
J. A. Llewellyn
K. E. Martersteck
J. Z. Menard
J. T. Raleigh
P. E. Reynolds
I. M. Ross
R. L. Selden
P. F. Sennewald
R. V. Sperry
J. W. Timko
R. L. Wagner
M. P. Wilson
Central Files
Department 1024 File
Department 2032
Library